Diamondback Terrapins In the World of Mercury

An Estuarine Indicator Species

Dave Owens
College of Charleston

Charleston Terrapin Studies

- Bill Roumillat, DNR
- Erin Levesque, DNR CofC - MS 2000
- Michelle Lee, CofC – MS 2003
- Becky Estep, CofC – MS 2005
- Gaëlle Blanvillain, CofC - MS 2005
- Jeff Schwenter, CofC - MS 2007
- Courtney Arthur, CofC MS Summer 2008

Funding/Support Sources

- College of Charleston
- SC Sea Grant College Program
- South Carolina Department of Natural Resources
- National Institute of Standards and Technology

Trammel Netting With SC-DNR

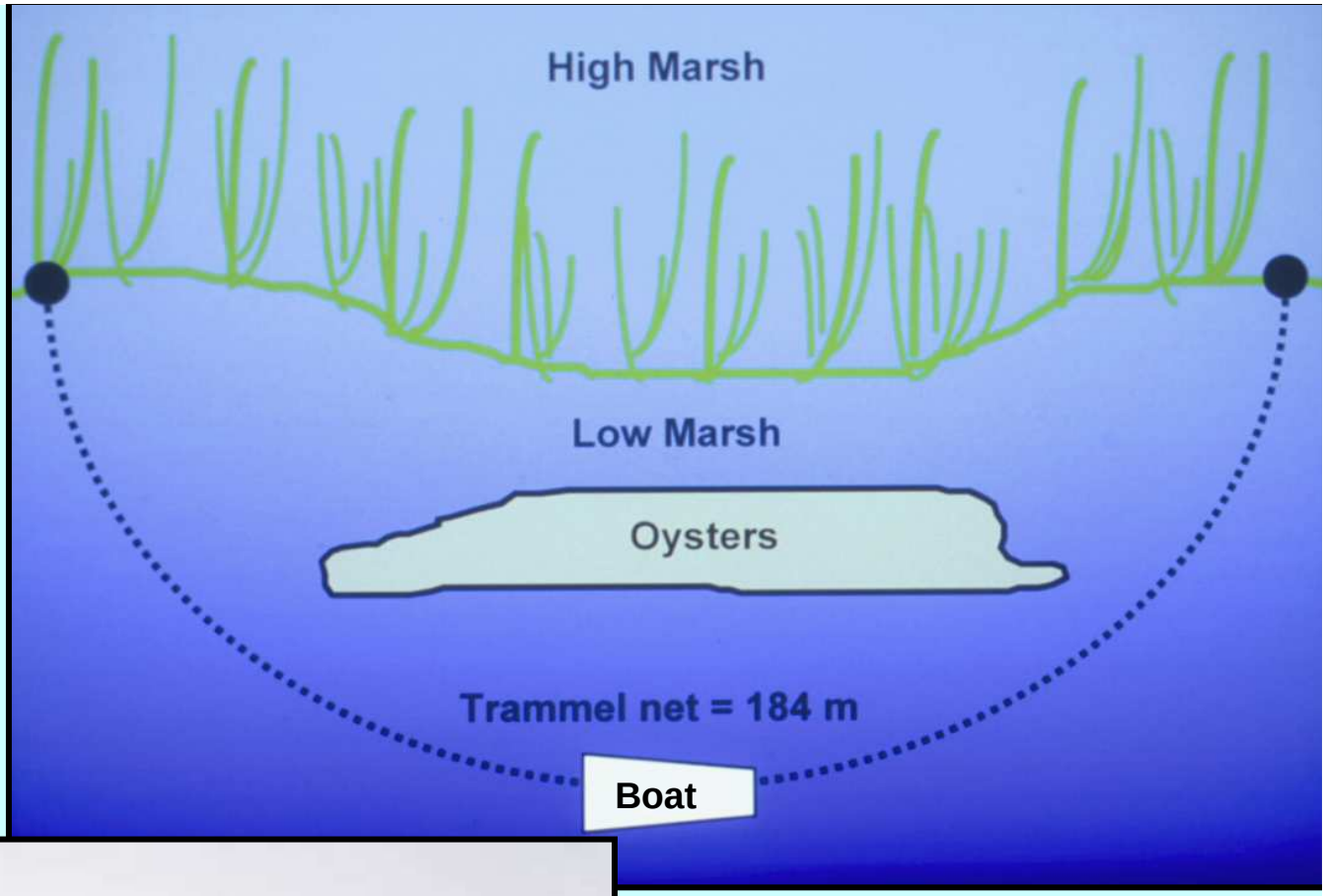
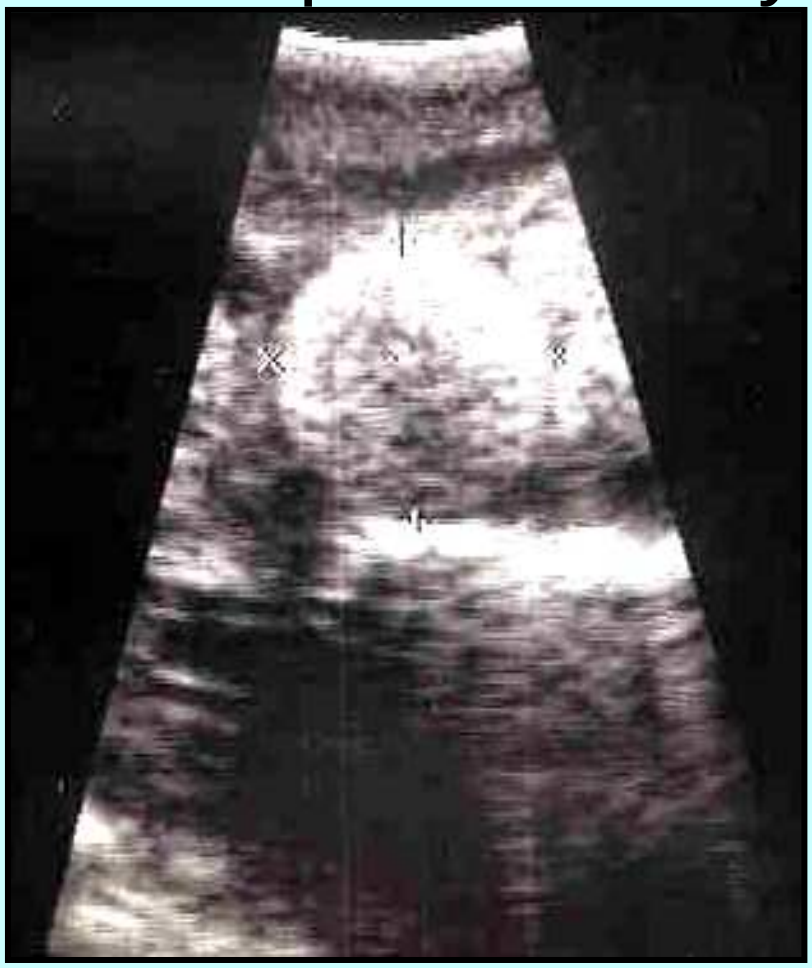
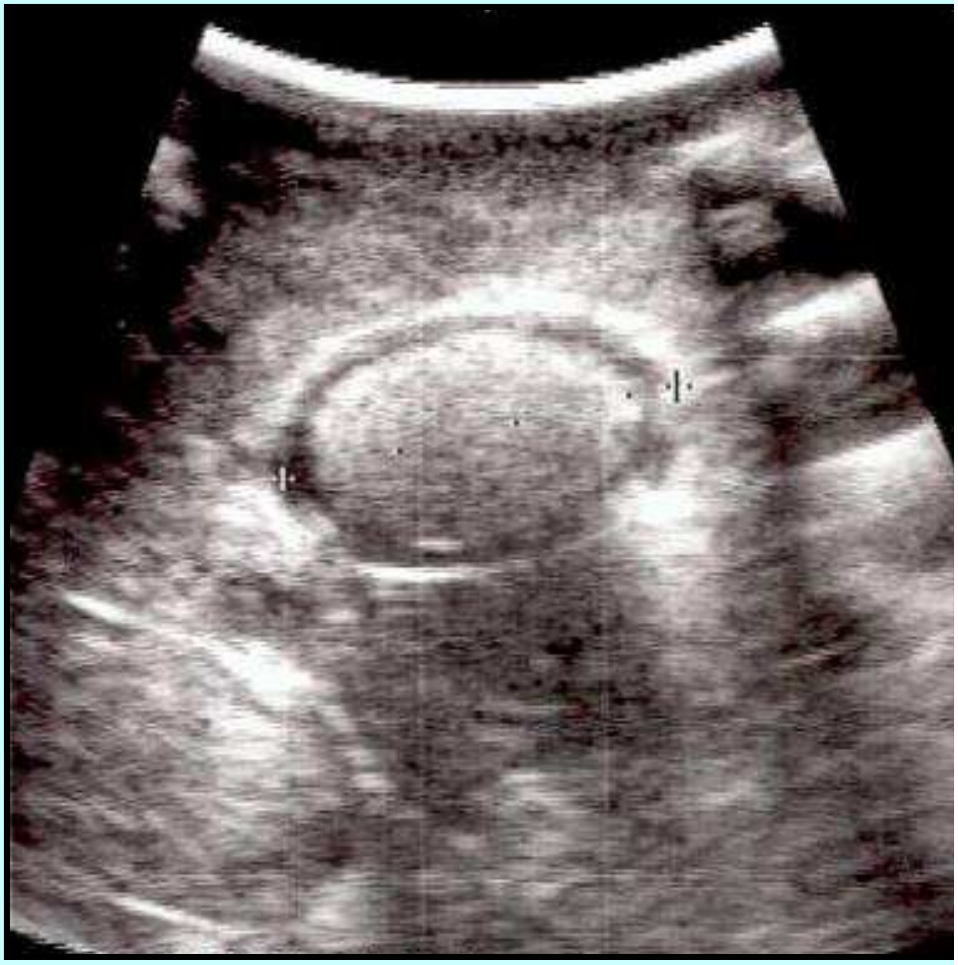


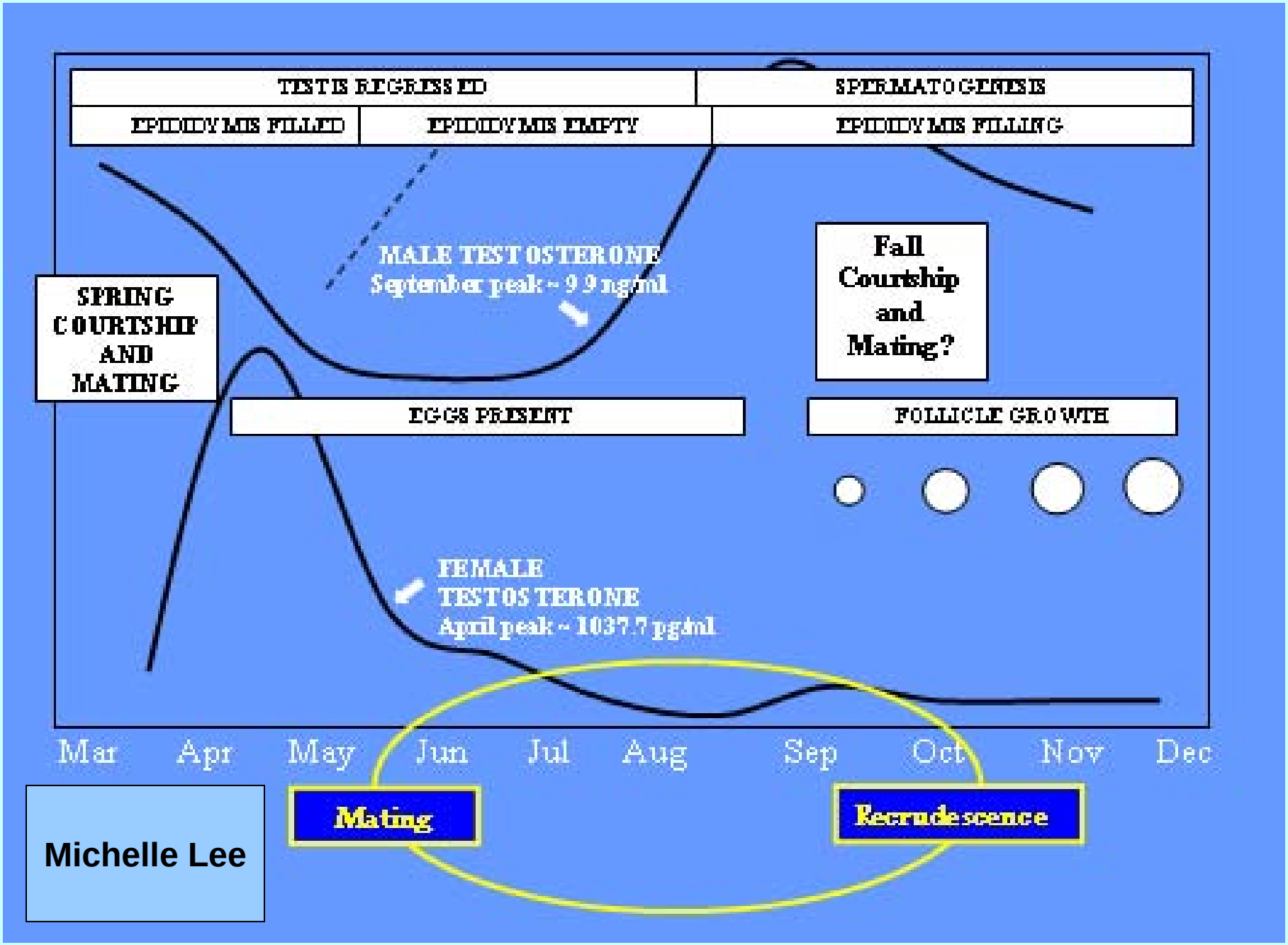
Photo: Michelle Lee

Reproductive cycles = Ultrasounds





Plus Laparoscopy and Endocrinology


TESTIS REGRESSED
SPERMATOGENESIS
EPIDIDYMIS FILLED
EPIDIDYMIS EMPTY
EPIDIDYMIS FILLING
MALE TESTOSTERONE
September peak ~ 9.9 ng/ml
SPRING COURTSHIP AND MATING
Fall Courtship and Mating?
EGGS PRESENT
FOLLICLE GROWTH
FEMALE TESTOSTERONE
April peak ~ 1037.7 pg/ml
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Mating
Recrudescence
Michelle Lee

Sonic Transmitter Attachment

Becky Estep

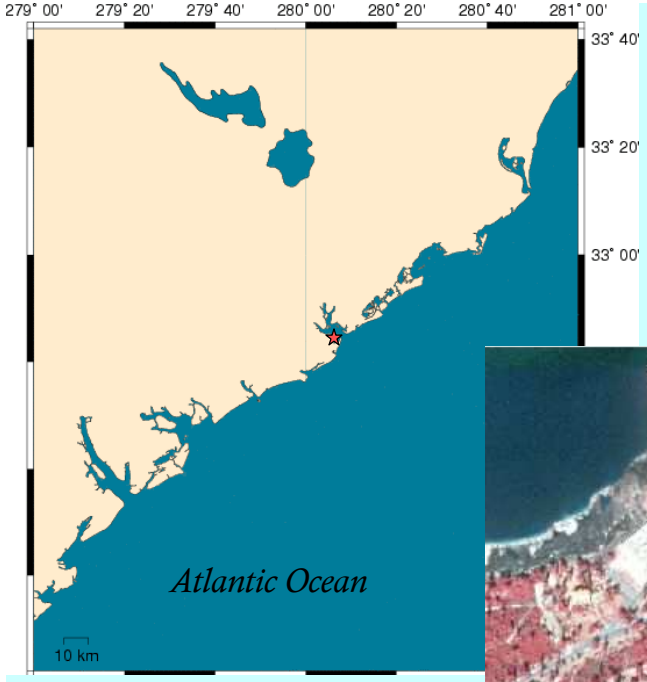
Season	Months	N tagged	Capture site
Fall 2002	Aug, Oct	8	Mudflat, Creek
Spring 2003	April	5	Rocks, Creek

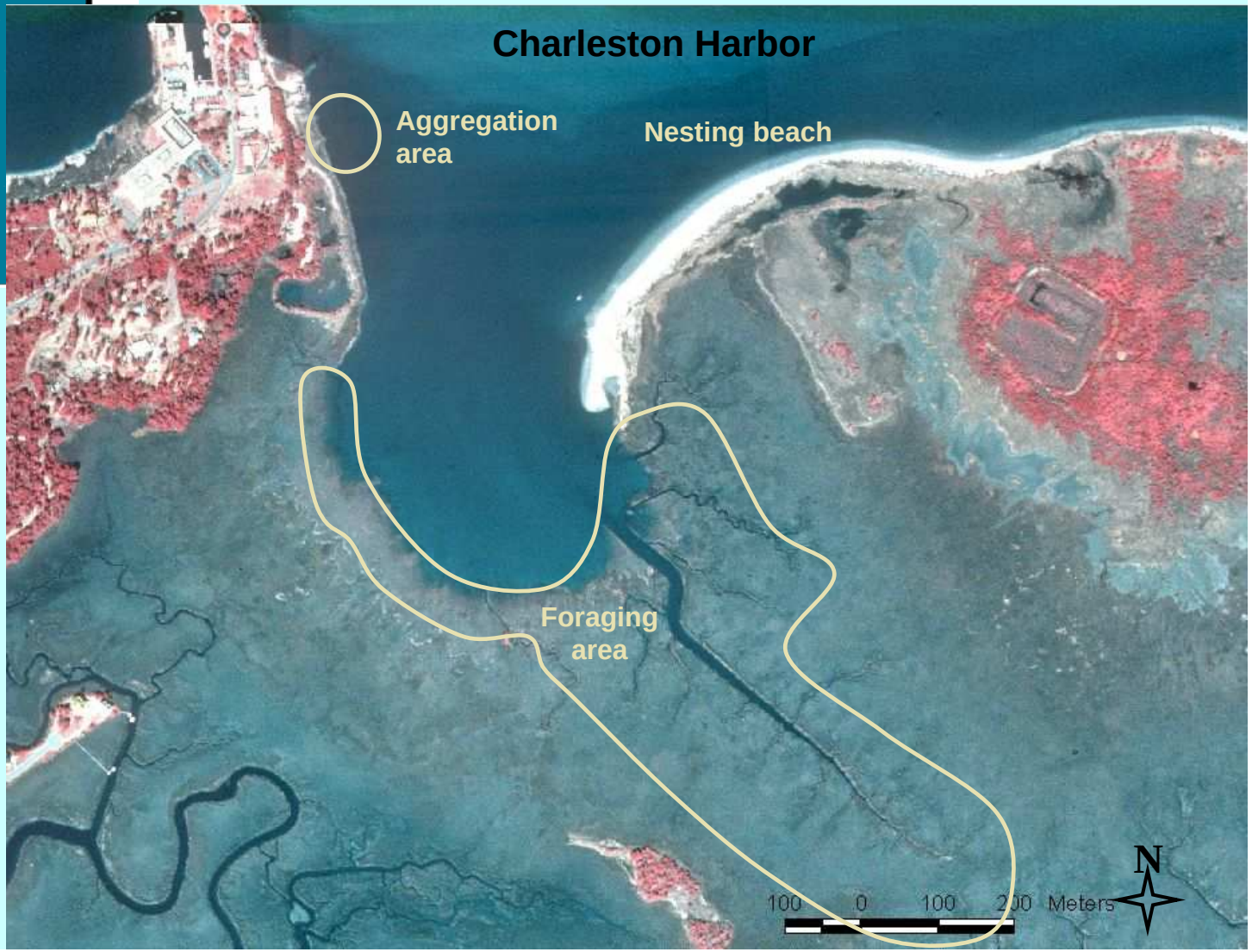
Transmitters attached after measurements and ultrasound

Sonic Receivers
VR2SC (Vemco, Ltd.)

- Continuously monitor cove sites
- Records: transmitter ID, time, date
- Temperature logger: water temp.
- Range: 40-50m max.; 120m in creek

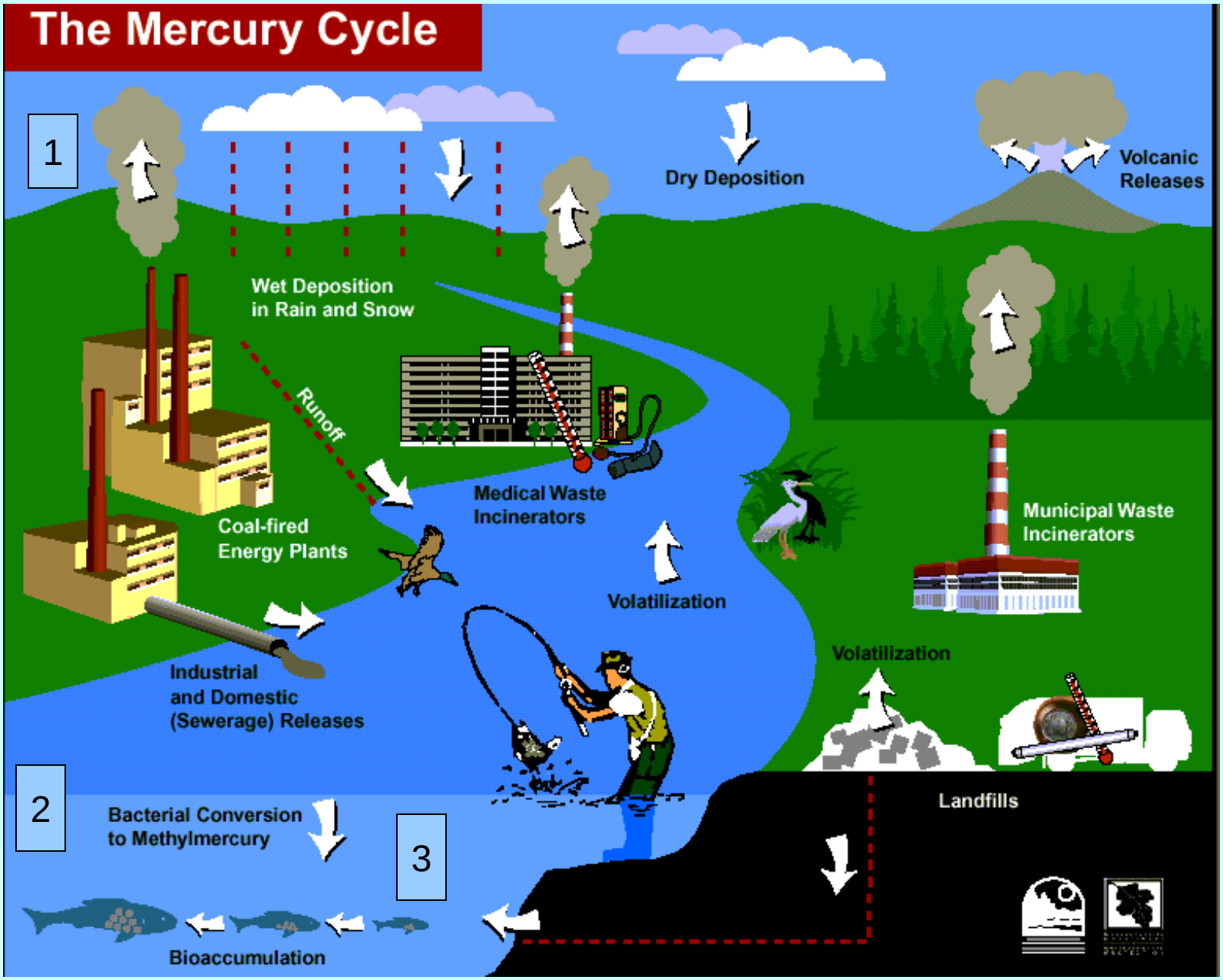
Study Area: Grice Cove





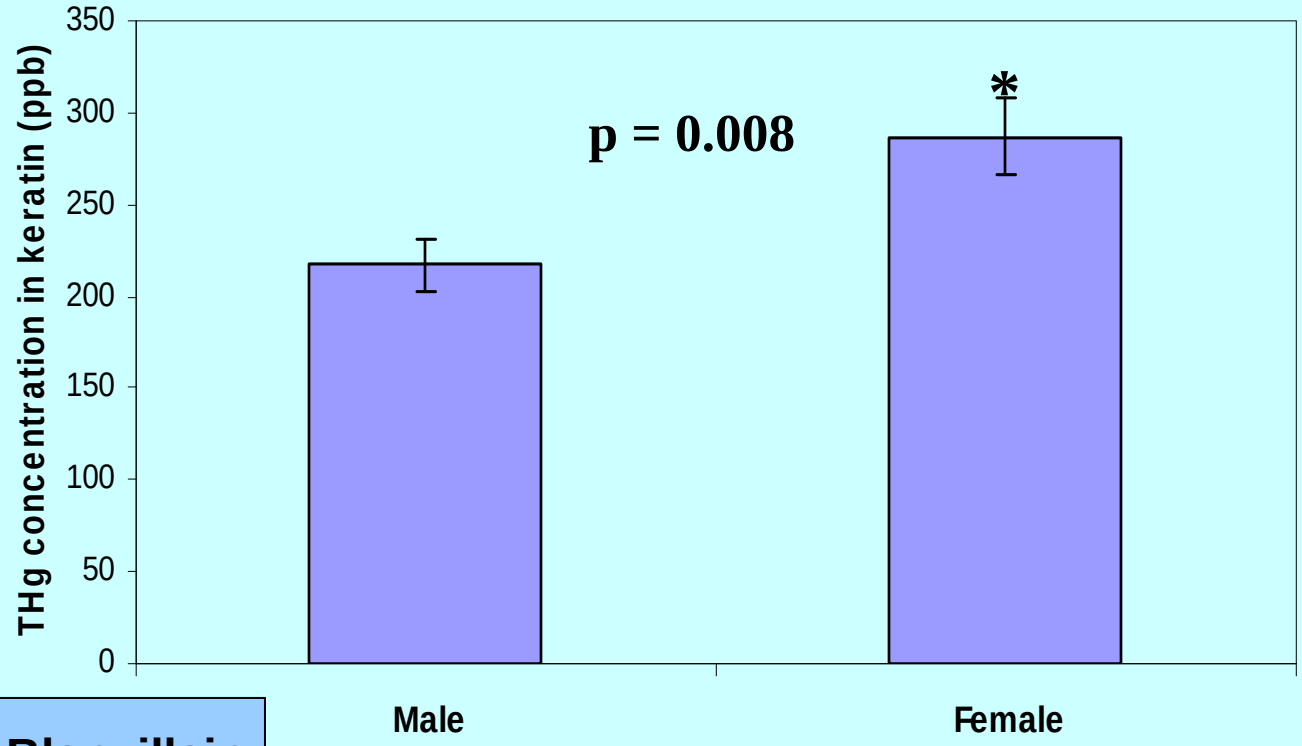
Real Home Bodies

Photo: SCDNR


The Mercury Cycle
1
Dry Deposition
Volcanic Releases
Wet Deposition in Rain and Snow
Runoff
Medical Waste Incinerators
Coal-fired Energy Plants
Municipal Waste Incinerators
Volatilization
Industrial and Domestic (Sewerage) Releases
Volatilization
Landfills
2
Bacterial Conversion to Methylmercury
3
Bioaccumulation


1. Shell Keratin
2. Blood Cells

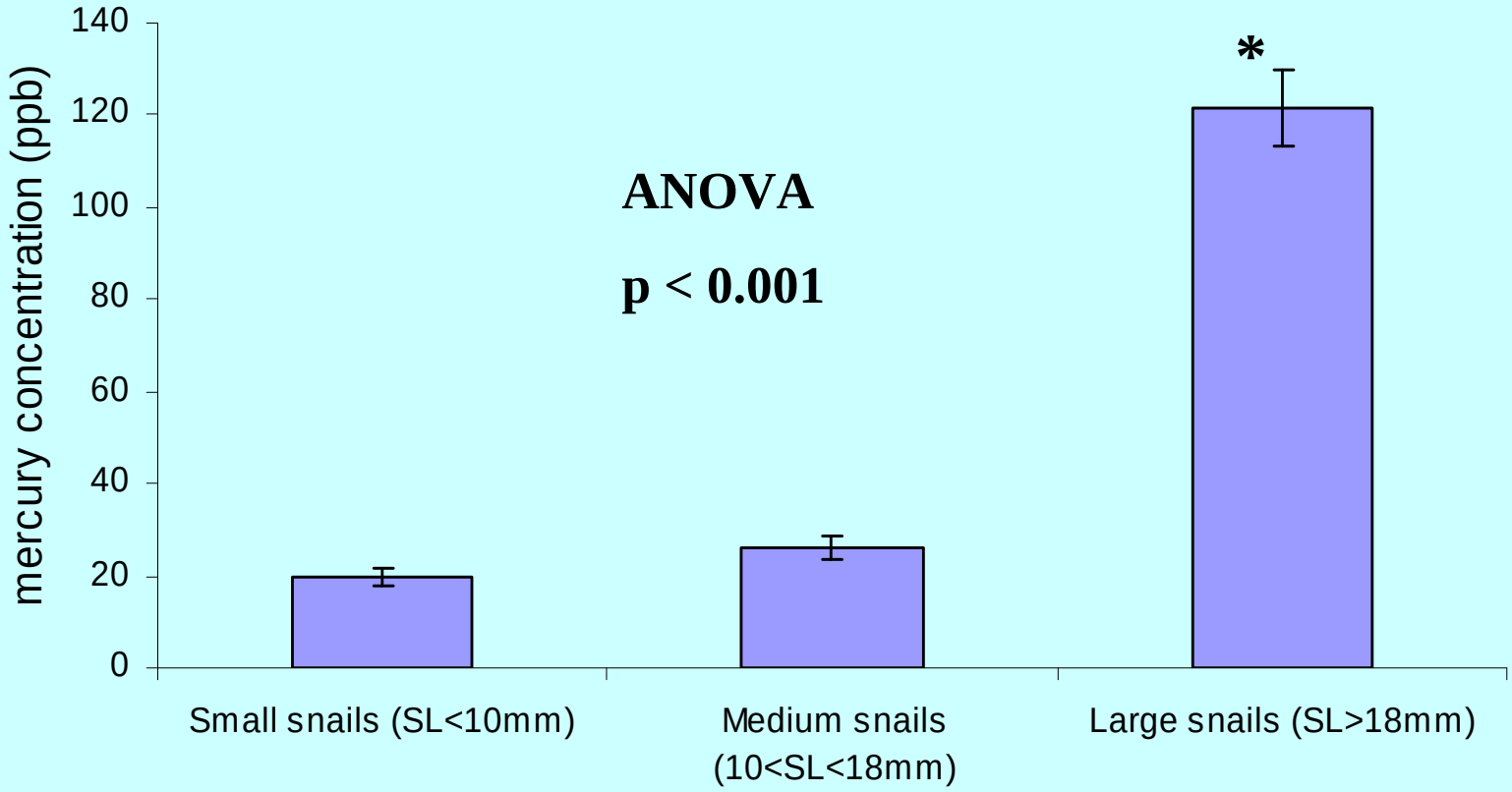
Gender effect on scute mercury concentration

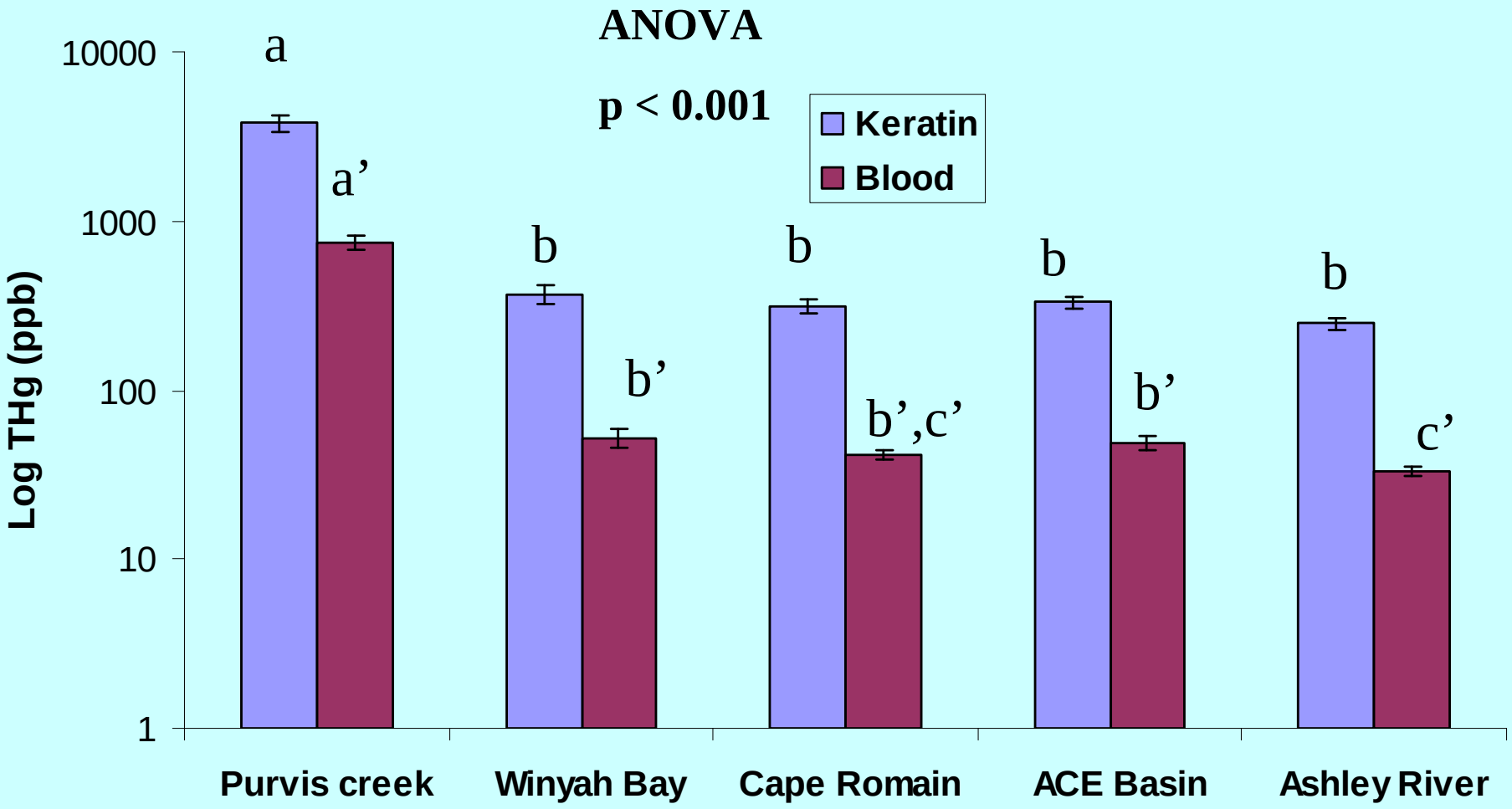


Gaëlle Blanvillain

- **Higher foraging rate?**
- **Eat bigger prey items due to sexual dimorphism?**

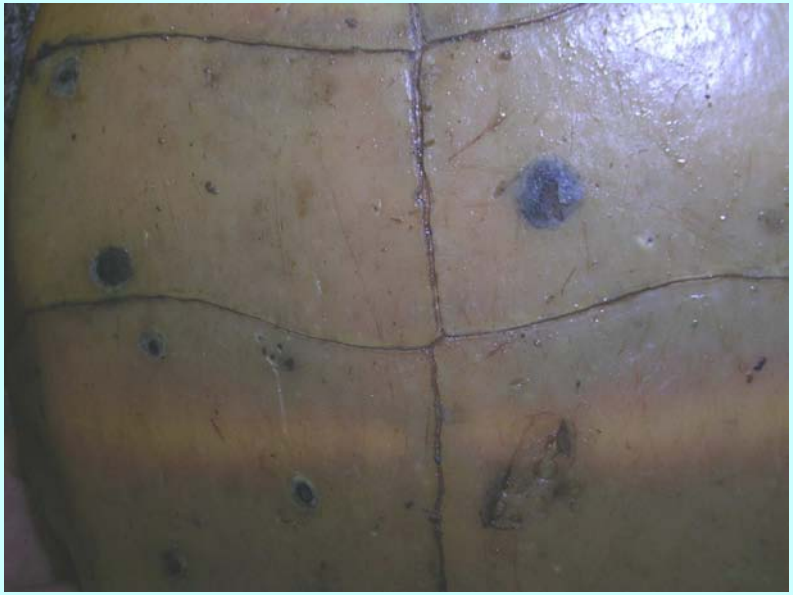
Variation of mercury tissue concentration in periwinkles depending on their shell size





Purvis Creek, Brunswick , GA
Superfund Site

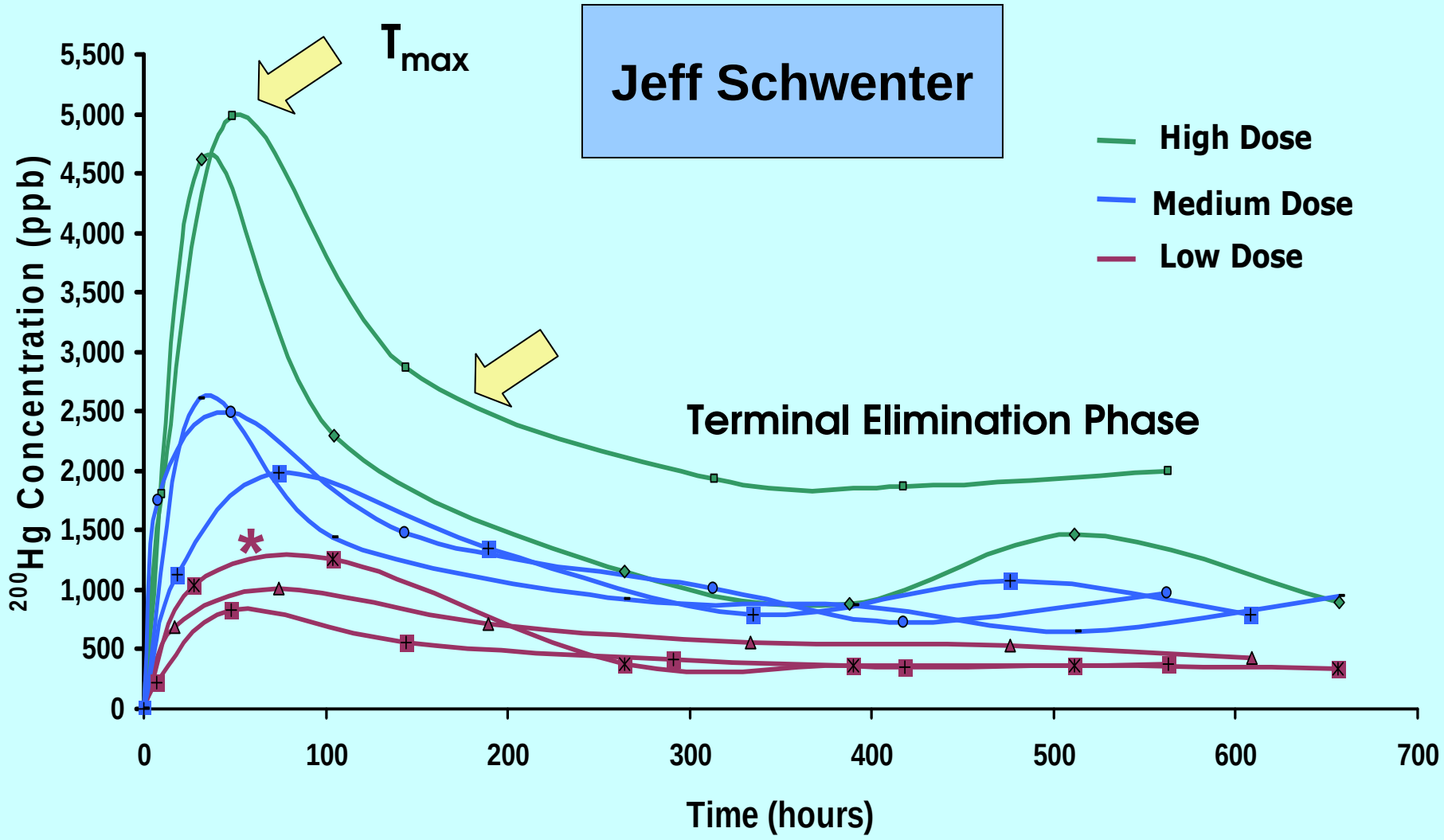
Brunswick turtles



Black necrotic area
See Gaëlle's poster

Dosing Experiments
2005

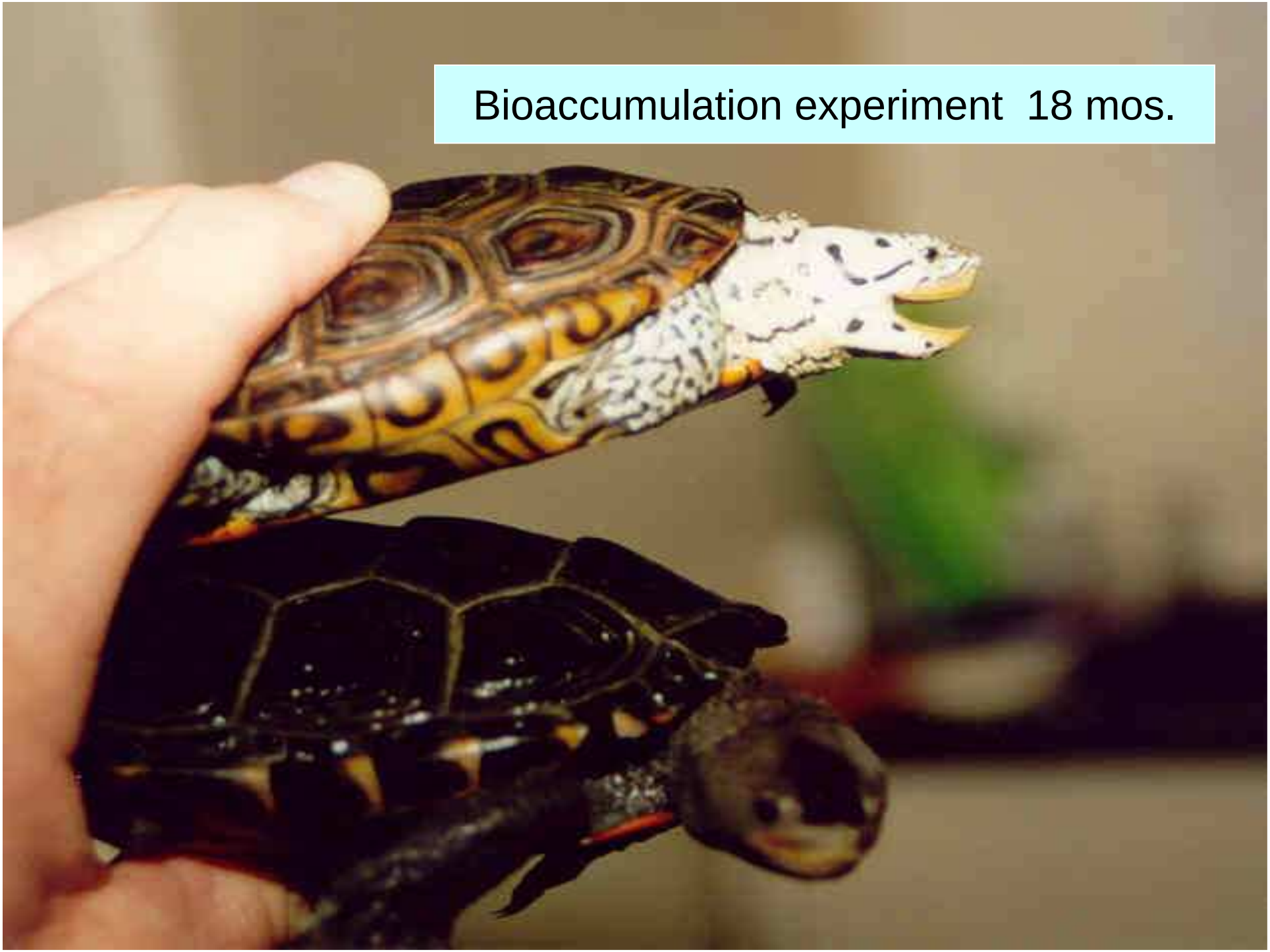
Results: Dose-Decay Curves



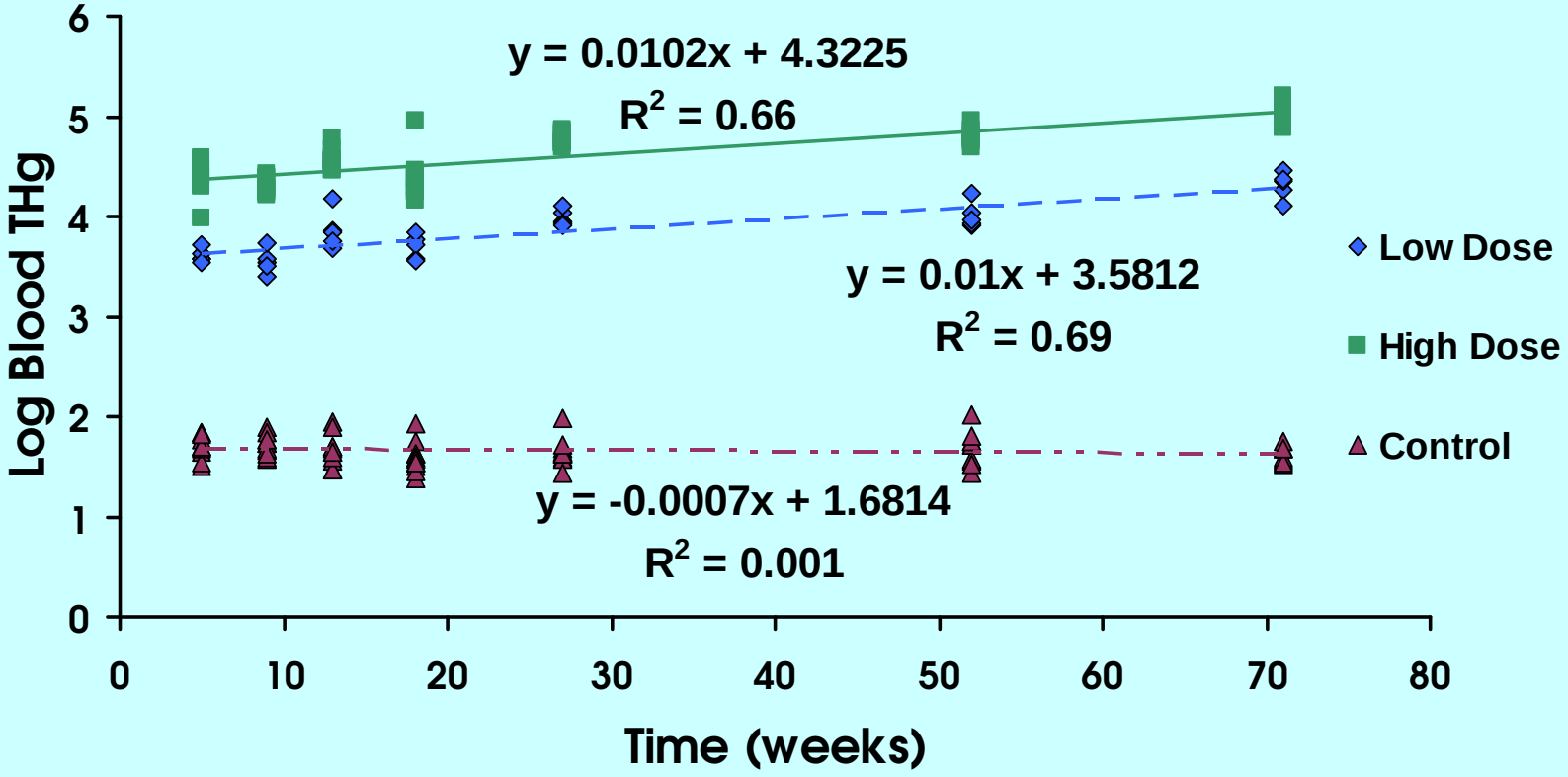
Summary: Kinetics

- Isotope dosing allowed tracking both dose and ambient blood mercury
- Dietary mercury assimilated into blood quickly after ingestion
- Ingested mercury present in blood long after dietary intake

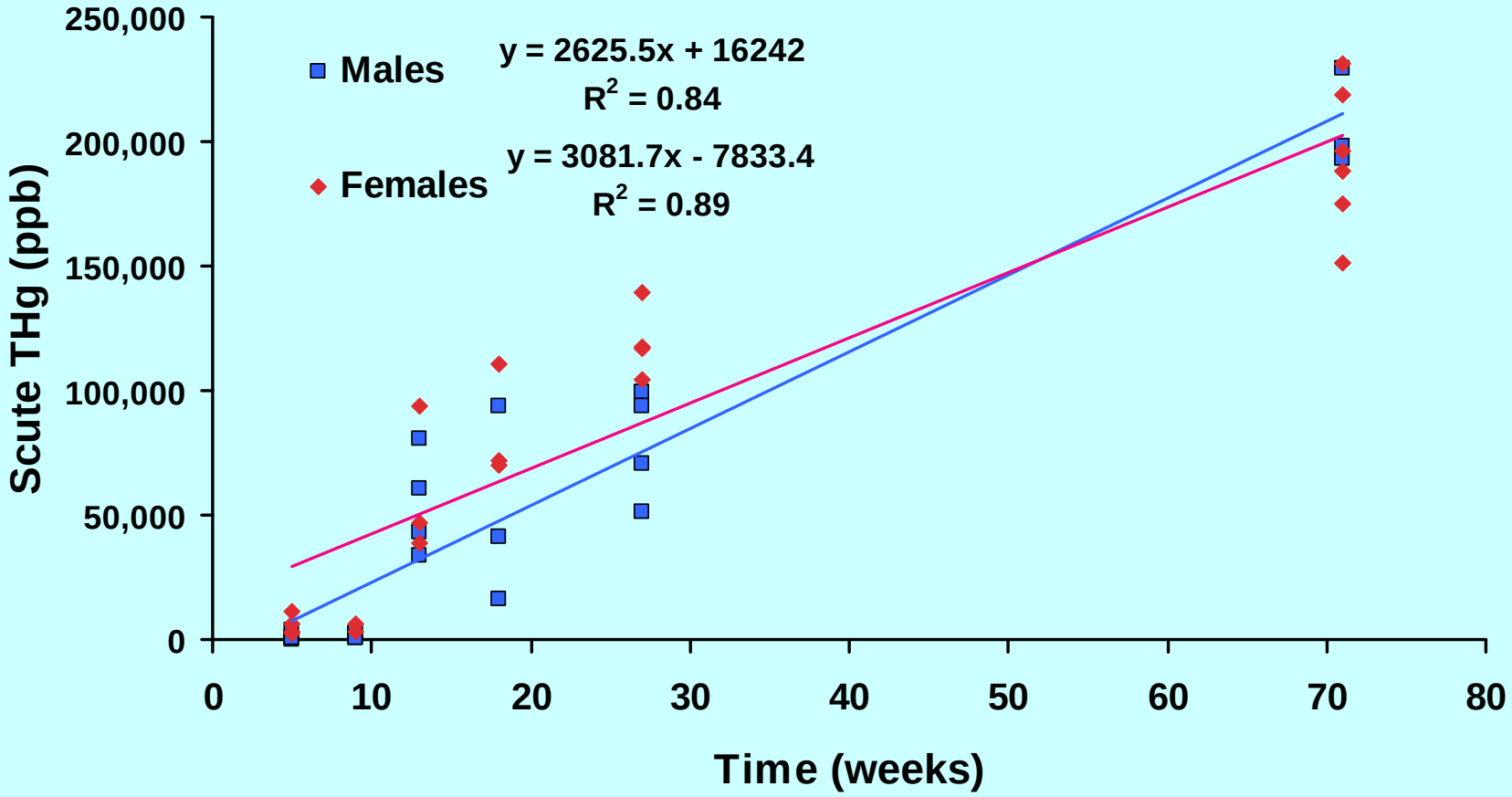
90% Elimination 71 Days


Bioaccumulation experiment 18 mos.

Results: Blood Accumulation



Results: Scute Accumulation



Which tissue is better?

- Monitoring: Scutes probably best - stability
- Short-term: Blood best for detecting rising environmental mercury
- Terrapin exposure/health: Blood and scutes together best for estimating risk

Patuxent River, MD

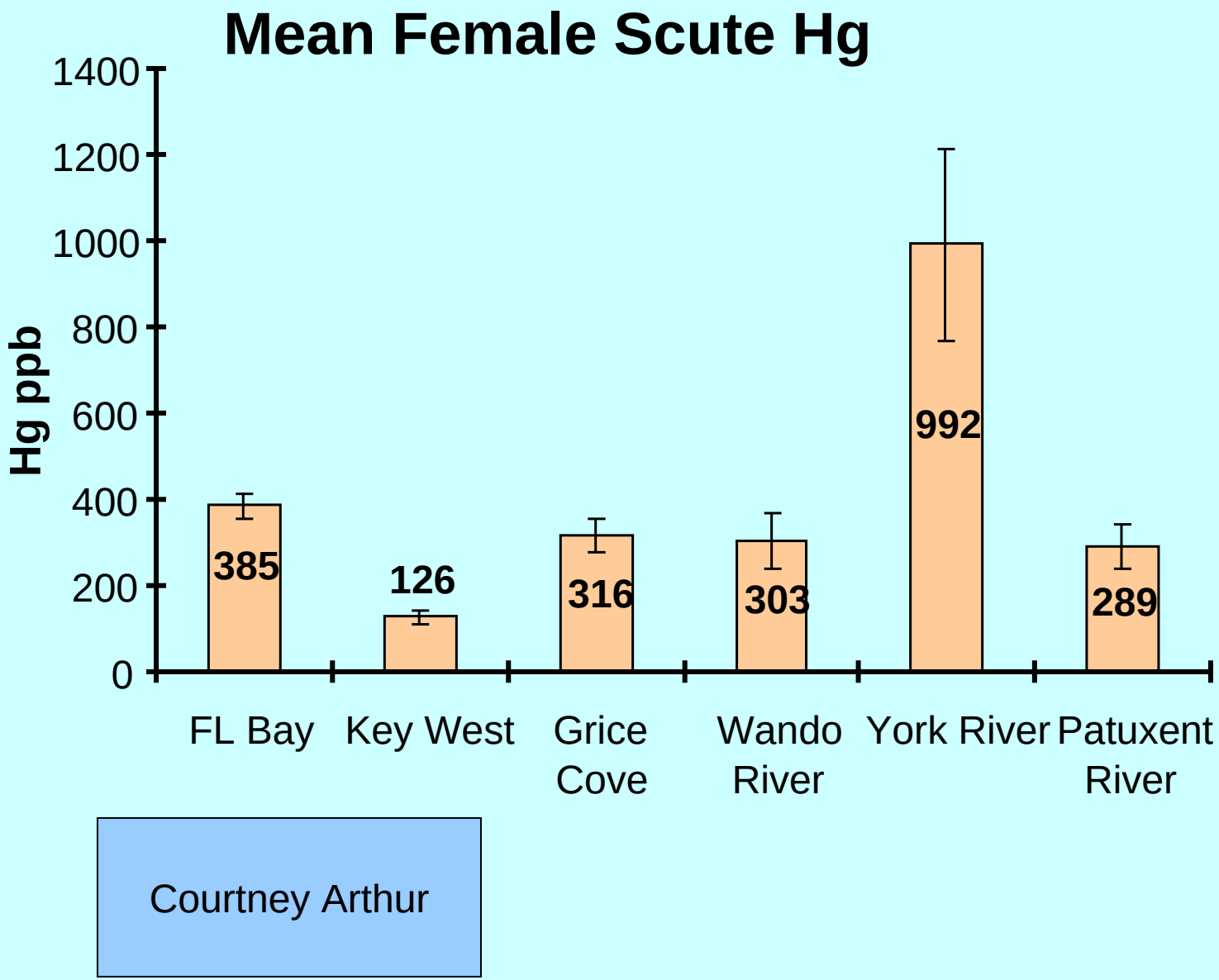
York River. VA

Courtney Arthur's study

Charleston, SC

Key West, FL

Key Largo, FL


Mean Female Scute Hg
Hg ppb
1400
1200
1000
800
600
400
200
0
385
126
316
303
992
289
FL Bay
Key West
Grice Cove
Wando River
York River
Patuxent River
Courtney Arthur

Putting It All Together: Conclusions Hg and Terps

- Blood and scutes useful mercury monitoring compartments
  - Home Body= specific Local contamination
  - Blood remains stable under consistent exposure
  - Scutes are useful long-term compartments, Immune to short-term blood variability

Sentinel or Indicator

Sentinel species

- "any non-human organism that can react to…an environmental contaminant before the contaminant impacts humans" (Stahl, 1997)
- Not very good -- Except Brunswick, GA

Indicator species

- "respond to environmental contaminants…in particular ways, based on scientifically supportable observations" (Stahl, 1997)
- Excellent